

AVIATION

SEPTEMBER 24, 1923

Issued Weekly

PRICE 10 CENTS



The Barling Bomber in Flight

VOLUME
XV

SPECIAL FEATURES

NUMBER
13

NAVY WRIGHT RACER FOR THE SCHNEIDER CUP
HOW MODERN RACING AIRPLANES ARE DEVELOPED
NAVAL AIRSHIP ZRI MAKES ELEVEN HOUR CRUISE
COMPARING AERODYNAMICAL PROPERTIES OF WINGS

THE GARDNER, MOFFAT CO., Inc.
HIGHLAND, N. Y.
225 FOURTH AVENUE, NEW YORK

Entered as Second-Class Matter, Nov. 23, 1920, at the Post Office at Highland, N. Y.
under Act of March 3, 1879.



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CURTISS AEROPLANE & MOTOR COMPANY, Inc.

Garden City, N. Y.

Buffalo, N. Y.



SEPTEMBER 24, 1923

AVIATION

VOL. XV. NO. 13

Member of the Audit Bureau of Circulations

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THE GARDNER, MOFFAT COMPANY, Inc., Publishers

HIGHLAND, N. Y.

225 FOURTH AVENUE, NEW YORK

Subscription price: Four dollars per year. Single copies ten cents. Canada, five dollars. Foreign, six dollars a year. Copyright 1923, by the Gardner, Moffat Company, Inc.

Issued every Monday. Terms close ten days previously. Entered as second-class matter Nov. 20, 1905, at the Post Office at Highland, N. Y., under act of March 3, 1907.

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Vol. XV

SEPTEMBER 26, 1923

No. 13

Airplanes for Night Flying

THE experimental road steps which the aircraft industry has produced for the Air Mail Service calls attention to the fact that the requirements of night flying will probably require certain changes in the performance of the Air Mail equipment. To use a DII mail plane for this work, except as a matter of expediency, would involve too serious handicaps. Forced landings with no fuel leading a ship would make such a night plane a serious detriment to the postal support of the necessary development.

It is obvious that the requirements of night flying will demand a type of ship that can land some 15 or 20 miles short than the regular DII mail plane. To accomplish this, a machine will have to be made in the high speed, but this is fully justified on the grounds of safety; while on the other hand a lower maximum speed is not so serious a drawback at night when the winds generally die down. Taking into account this inherent advantage, it will probably be found that the slower flying and slower landing night mail ships will cover the night route at about the same rate of speed as the regular DII mail planes do over the daylight route. Such were the considerations governing the design of the experimental mail planes produced by the industry, all of which have much lower maximum and maximum speeds than the regular DII mail plane.

Of course it will take some possession at first to overcome the average Air Mail pilot's very natural devotion to the regular Mail DII and the Liberty engine, which were then so well for day flying. However, most of them realize very well that the Mail DII is not made to night flying, and the opinion to use specially designed equipment is, in a rule, supported by the pilots.

The whole problem of giving the Air Mail Service suitable equipment on sufficient numbers for its night flying must be frankly placed before Congress. The splendid record which the Air Mail Service has written into the annals of aviation would be unequalled for safety and reliability—has given America an enviable place among the leading nations of the world. The recent study of our Air Mail status by a distinguished officer of the British Air Mail Service emphasizes this fact. By turning the expansion of the Air Mail Service into night flying activities, the chief desideratum which will give our transport its commercial justification, Congress will build up a national asset which cannot be priced as valuable in price as in use.

The Early Pioneers

DURING the recent war, the Army Air Service had the commendable thought of honoring several pioneers of aviation, as well as some prominent Air Service pilots who

had been killed in action, by naming flying fields after them. It is suggested that this practice be continued, not only in the case of Army flying fields, but also with regard to municipal and other airports.

Among the early American pilots there were a good many whose fame was not confined to this country and who have been too quickly forgotten. To mention but a few of them, there was John Hammel, the first man to fly from Paris to London; Archie Hovey and Ralph Johnsons who established several world's records at a time when the history of the air was beginning to take form; America's first, C. K. Henshaw, the first man to fly from America to France, C. K. Henshaw, the first man to fly from coast to coast; the famous Red Bull, the first man to fly from the Middle West, and Lucinda Bonney, the pioneer woman and also the first aviator.

This list could be considerably enlarged, as it only includes those who were particularly in the limelight. Among other early pilots who should be honored by naming fields for them may be mentioned Phil Pinesdale, Eugene Ely, John P. C. K. Henshaw, Charles Welch, Ted Sturges, Al Welch and Cecil Peck. The work done by these men in preparing the airplane, which in those days often involved very serious risks, deserves to receive lasting recognition.

In the domain of lighter-than-air craft similar recognition should be given the work of the pioneers. To mention but the most prominent, the names of John Wise, Capt. Thomas Baldwin and Milton Vaniman should be given to balloon and airship stations, so the memory of these men may live among those who follow the steps of the pioneers.

Those Traveling by Air

PASSENGERS report from France bring out the remarkable fact that few Frenchmen possess the extensive French baggage.

During the month of August Frenchmen comprised only 25 per cent of the passengers traveling on French commercial planes. American was the greatest customer of the French air companies, providing 53 per cent of the commercial air travelers. England was second with 36 per cent, and Holland third with 6 per cent.

The probable reason for this somewhat startling lack of French passengers is found in the fact that the French travel less outside their own country than do almost any other national, and that the expense of air travel is still above the average Frenchman's purse.

The fact that over half the passengers were Americans indicates that once they are offered opportunity to fly from one city to another and comfort, Americans will pay the price to save time and inconvenience by utilizing air routes. The history of the motorbus and the automobile easily prove this contention.

Naval Airship ZR1 Visits New York City

Big Rigid Covers About 600 Miles Over the Atlantic Seaboard
In Flight of 11½ Hours' Duration

New York City was treated on Sept. 10 to the most notable of a rigid airship maneuvering in its class, when the U. S. naval airship ZR1 rounded the island of Manhattan in the course of a highly successful flight of 11½ hours' duration, her first extended cruise since her maiden flight on Sept. 4. This was the first opportunity New Yorkers have had to view a rigid airship in flight in all daylight, for the 874 of transatlantic fame was last seen, for a few brief instants when smoke-lights revealed her outline over Times Square the night she landed back for England in 1919.

Intense interest with aircraft circles astronomical was, as a rule, indifferent to the subject, the result of air navigation. Laymen are more apt to judge from this point of view. That

effort, intended to carry out some maneuvers which had not been attempted in any of the three previous flights all of which were of brief duration. These maneuvers included climb to 7000 ft., valve testing, turning astern and speed up to 30 knots.

When they had been completed, Commander McCrory radioed back to Lakehurst: "Over Times River. Completed test of valves. Coming down to about 3000 ft. With course in this vicinity for about an hour. Shortly New York will leave Lakehurst 8 a. m. daylight saving time and leave Bureau of Aeronautics 11:30. Shortly Philadelphia will fly over that city at 3 p. m. McCrory."

This program was carried out with a precision which—



Official Photo U. S. Navy

On the left, Comdr. Frank R. McCrory, U. S. N., at the helm of the ZR1—on the right, the control car of the ZR1 seen from below

the appearance of the ZR1 over New York caused a great thrill of delight to the onlookers to be shown by the newspaper reports and editorials dealing with this event which appeared the following day. As typical of these feelings we quote from the account in the *New York Herald*: "In the beauty of the vast ball, gas-filled, lined as a duck and so definitely colored as a leopards' coat, floating in the air and seeming so majestically above the buildings in the height of which New York takes pride, people forgot the doubtful purpose behind all the beauty." In an editorial entitled "ZR1 and the Eclipse," the *New York Herald* said among others:

A Beautiful Vision

"New York City paid more attention to the spectacle than it did to the eclipse. When that glowering new airship of the Navy sailed majestically over Manhattan and the Hudson the eyes were filled with startled faces. From roofs and windows many watched the military ship and anxiously scanned a background of blue sky, and then went back to their work, the richer by a beautiful vision."

"ZR1 is a new's dream come true through the labor of many men. Even the landlubber himself, being watching her at work against the blue mist to be drilled with a just pride in belonging to a man that can create so much a scene."

The ZR1 left the naval air station at Lakehurst, N. J., at 7:20 a. m., heading for the New Jersey shore. At 8 a. m. she was visible from Atlantic Highlands. Before proceeding to New York, Comdr. Frank R. McCrory, her commanding

officer, intended to carry out some maneuvers which had not been attempted in any of the three previous flights all of which were of brief duration. These maneuvers included climb to 7000 ft., valve testing, turning astern and speed up to 30 knots. When they had been completed, Commander McCrory radioed back to Lakehurst: "Over Times River. Completed test of valves. Coming down to about 3000 ft. With course in this vicinity for about an hour. Shortly New York will leave Lakehurst 8 a. m. daylight saving time and leave Bureau of Aeronautics 11:30. Shortly Philadelphia will fly over that city at 3 p. m. McCrory."

Escorted by Three Planes

Escorted by three Bellanca planes from Mitchell Field, piloted by Lieut. E. B. Baraband, Clyde B. Finner and Newton B. Lewis, the ZR1 proceeded toward the river at a height of about 1500 ft., that of the sea surface during the ship's time at 45 m/hr. When about of the latter of Lakehurst the ZR1 executed a graceful dip in salute.

Passing over Lower Manhattan, Commander McCrory followed a course up the North River, the ship's progress being marked by the tooting whistles of harbor craft and fireboats.

Traveling northward as far as Washington Heights, the ZR1 turned eastward as far as the East River and then



The U. S. naval airship ZR1 in flight, and below, her officers: (L. to R.)—Lieut. A. R. Humphreys, Lieut. L. E. Muehle, Comdr. F. H. Kim, Lieut. C. H. Rosendahl, Lieut. M. R. Pierce, Lieut. J. C. Arnold, Lieut. E. H. Kincaid, Lieut. H. J. Wiley, Lieut. R. J. Miller, Lieut. R. F. Taylor, Lieut. J. B. Anderson, Comdr. F. R. McCrory, commanding officer of the ZR1 in last in this picture. In the R. H. corner, Comdr. R. D. Weyersbacher, looking out from the control car

headed back to the harbor, accompanying the 25 m. air ship in about half an hour. Returning to the main shore Governors Island the ship, last in view, started on its flight to Jersey, where it was to arrive at 7 o'clock.

The airship passed over the Philadelphia City Hall at 2:30 p. m., dropping at the rate of 45 m/hr. at an altitude of 5000 ft., executing a graceful swing around and heading back to Lakehurst. The ZR1 trailed the sea stream at 7 o'clock, when 250 onlookers and sailors were waiting to "watch" the ship into the harbor. It was a third but longer crew of 100 men and 2000 sailors and men that headed out of the five men and from the interior of the hull after the craft had been until headed.

The following account of her cruise, written for the *New York Tribune* by Comdr. Ralph D. Weyersbacher, U. S. N., the officer who has been mainly responsible for the engineering and handling work of the ZR1, is reproduced by courtesy of our contributors:

"Had the ZR1, super-dreadnaught of the air, been over New York today on a warlike cruise we could have destroyed public buildings, blown great holes in the crowded streets and reduced the metropolis to a state of panic unparalleled in history."

"Following today, up the Narrows, had we carried the five tons of high explosives the giant dirigible over them, we could have demolished the guns of Forts Hamilton and Wadsworth and lifted the ringing alarm-bells from the water, in speaking of lesser cities on the coast."

What Might Be

"The handsome German House would have been as my target, the Broadway would have been charmed up with debris from toppling skyscrapers, the City Hall and Postoffice would have gone and gaping holes would have marked what are now Union, Madison and Times squares. "I could not help thinking as I stood by the starboard rail in the control car of the air locomotion while we cruised Manhattan Island, what previous destruction may be wrought by evil-laden, over large cities, of such floating battleships as the ZR1 can be developed to a point where they can immediately smother another attack."

However, the ZR1 is not a heading craft and our visit to New York was an entirely peaceful one. The prime function of this and similar airships is to act as a long-distance eye in the Navy. The ZR1 was designed as a water-tight vessel, to meet the new line of war for ages of many first movements.

"This first daytime trip of a great dirigible to New York (the R54, an English airship, ground over part of the city at 11 o'clock one morning during her American stay) is only an incident in our ambitious program on behalf of lighter-than-air craft in the American navy."

Proved Safety of Craft

"The whole trip, encompassing eleven and one-half hours' time in the air and covering nearly 600 miles over the Atlantic seaboard, was a tremendous success. At this moment, having only drifted from the ZR1 and without having had time to go over the observations carefully, I can say that we have proved to the satisfaction of our own officers at least that the largest airship in the world, designed and built entirely in America, of American materials and with American hands, can be flown with entire safety and maneuvered in an efficient way of the Navy."

"I trust I will be pardoned if I dwell for a moment upon the Navy's achievement in the ZR1. We met only both the largest lighter-than-air vessel afloat, but we experienced with apparent success with a new element, the non-inflammable gas, helium. No other dirigible has used helium."

"Today's flight demonstrated that, in spite of the disastrous consequences of earlier experiments with the Zeppelin form, we have an airship capable of taking the air for long hours and returning with less danger to the crew than in some sorts of land transportation."

"As we glided over New York the chance of our crashing to earth was no slight one to be negligible. We rose and fell at will, riding easily over bumps that would have rocked smaller craft, due to air balloons and currents of air below. Noting that we can descend could have saved us in several such a thing, though we weighed as we flew more than 180,000 lb. of metal gas."

"Our day's recording the stream and stream on the main north frame, longer than the Washington Monument, showed us we had a margin of safety of two and one-half under the worst conceivable circumstances in the air, due to status or slight air."

No Danger of Expanding Gas

"Experiments with the automatic safety valves on the gas bags demonstrated that they operate automatically at the 'pressure height' which today was 6300 ft., and there is no danger of the balloon expanding and bursting out at high altitudes. The restraining valves also worked in perfect balance, enabling us to elevate and depress the ship easily."

How Modern Racing Planes are Developed

By FRANK R. RUSSELL

General Manager, Curtiss Aeroplane & Motor Co.

When the 1923 Pulitzer race was over and the new world's record of 200 m. per hour made by the winner announced, and later when the same plane landed at the rate of four miles per minute in establishing a new world's straightaway record, it appeared as if the obstacles must have been reached in speed.

However, as a new year rolled around and the Pulitzer race was again under thought of, the question arose: How can



High speed wind tunnel at the Curtiss plant, Garden City, L. I.

this speed be increased? This was the question that confronted the Curtiss Aeroplane and Motor Co., Inc., when they were asked the question in the Navy for the building of two new planes for this year's Pulitzer race. They have already produced a machine which appeared to be perfect in every respect, the question arose: How could it be improved again?

Development Takes Long Time

There is sometimes a misguided idea that the development of an airplane can be obtained in a short time in three days of intensive engineering. However, this is not true and is especially borne out in the development of a fast racing machine. As the 1923 Airco Race was a development of many kinds of study, experiments, and research extending over a period of many years, not by one man, but by a large corporation composed of men who are specialists in their lines, the further development, even if small, must be made in the same way.

Therefore, the problem that confronted the men who had pushed what appeared to be as fast a machine as possible in 1923, was to produce in less than one year's time, a faster machine using practically the same power plant. Immediately, a conference was called by the Chief Engineer of the men who are going to try and solve a problem which year by year is getting more and more difficult. This conference was composed of the Chief Engineer, the Assistant Chief Engineer, the Chief Motor Engineer, the Executive, Technical, Design and Project Engineers, the Chief Draftsman and ex-

perts in the Propeller, Aerodynamic and Structural phases of the work. These different men being present in order to present their own design from the start. Each man gives his idea of how he thinks the machine can be improved upon and divides up the ideas proposed. One man says, "Build a propeller, make a rudderless chassis, and there you are." Another replies, "How will you attach the chassis," which makes the first man think, and then the discussion is on. At each opinion made, someone points out the difficulties that will prevent themselves in either use the idea, or solve the problem that must be met before it is practicable.

However, from this conference are born hopes as some of the ideas suggested appear to clear up in a certain extent the problem before them. A list of the different suggestions is made and each man has his part to do and he starts out to do it. The Motor Engineer has the problem of getting just a little more power out of his motor without paying the fuel and reducing its efficiency and tractability. The Propeller Engineer is confronted with how much he can get the efficiency of this unit be increased and just how can it be done. To the Aerodynamic Engineer falls the task of investigating and developing new wing curves, better fuselage shapes, better strut surfaces, and numerous other details which



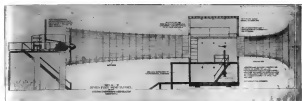
Model of a streamlined body mounted on the aerodynamic balance in the Curtiss wind tunnel at Garden City, L. I.

were brought out in the conference. The Structural Engineer must build the structure of the airplane stronger but lighter, an increased speed means increased loads, but weight must always be kept at a minimum. To keep the weight reduced, engineers specialized in weight control also investigate their phase of the problem. Again, to decrease the weight of the machine requires an expert use of materials. Hence, the metallurgist is consulted and men who are expert in the proper heat treating of materials, as the problem is again discussed.

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Diagrammatic cross-section of the high speed 7 ft. wind tunnel at the plant of the Curtiss Aeroplane & Motor Co., Garden City, L. I.

as in other words, the getting of something out of it as fast as is possible. The Project Engineer then has the problem of taking these different suggestions and making them together. This necessitates expert advice as one person may do all this. He is, then, consulting men who are expert in their line, by which his confidence and assigns them to their various duties.

Each Man Has Distinct Task

It is hardly seen that each man has his duty to perform and he begins it. As the suggestions and improvements are made, a definite type of machine is decided upon and then a definite number of procedures is made, each man being assigned definite tasks. The wind tunnel is busy and the wheels at the end of the days work means nothing to the engineer in charge as his task must be clear before some one else can begin. His work is of great importance since it is here that the aerodynamic qualities of the machine are tested. Parts are tested with different streamlines to see if the resistance of this machine can be decreased even to the slightest extent. Then a complete model of the machine is made to verify its predicted performance, to determine its stability and controllability using the results of these exhaustive tests indicate whether the machine has fulfilled the expectations of the men who have worked so diligently on it. The preliminary work completed, the structural engineers investigate it for strength, every part of the machine from the most structural members to the smallest bolt and fitting being carefully analyzed. The weight department then investigates to see if it is light enough, the draftsmen then make the drawings and it is again checked both for strength and weight. Each part then passes through practically the same procedure and finally the drawings go to the shop to be built.

Then, under the guidance of the engineer in charge, parts by piece are finished, inspected and if of the finest workmanship they are ready to be put in the finished machine. Even with all this care and thought, this is not sufficient. No man can be left satisfied to sit only make the machine as fast as possible, but it must be as strong as possible as the reputation of the company is as much at stake as the latter, as to the former. Tests are made of different parts of the machine, some to verify figure loads, others to determine points where to strengthen, as to whether they can be properly attached or not, and others to obtain data for use in the future. Important in knowing just what tests should be made is of very importance, especially in a racing machine.

The tests over, the assembling of the machine is now made. Each man has his part to do and they in turn are brought placed together until they present the complete machine. Though this work, a strict and rapid inspection is maintained and it is of the highest importance that not one defective part should enter the machine. Even the finish is

carefully maintained and every part that one possible point is covered up or scratched as it is these details, although small in themselves, when added together, make a difference that is of high importance.

The machine, now finished, is lowered into water ready for flight. It must be carefully weighed and its center of gravity obtained to see if it checks the predicted result and if it is not to be without adjustment the center is fixed and the propeller adjusted and the machine is then ready for its flight tests, and turned over to the pilot who must be carefully chosen so that his qualifications will blend with the carefully designed machine and will make the most of the engineers who have so carefully brought this machine up to this final stage. These tests are the machine's evidence as to whether the machine has fulfilled the predictions of the engineers or not. If it can, well and good, if not, it is a question of one more or failure.

As can be seen from this short synopsis of the procedure that is necessary to create a machine as near perfect as possible in a relatively short time, it is of high importance that the men are well selected, that each man has his definite duties to perform, that there is no overlapping and confusion of work. Everything must be done as efficiently as possible and the proper machine must be at all times as well as the machine that has not mistakes are eliminated as near as possible and the machine turned out as predicted both in performance and time. The also necessitates the proper equipment, not just a good machine without tools is handicapped as is a good engineer without equipment. He must have available a well trained to verify his performance predictions and determine his machine and design sharp a testing laboratory to make his tests to verify both strength and design, equipped for testing motors and propellers, a well kept filing system with all technical information that is necessary, books represent other lesser requirements to help him in the various difficulties and problems that confront him before the part is reached.

All this is necessary, before a machine is turned out which will be an improvement over what has gone before, because as mentioned, only year the task is becoming more and more difficult and the obstacles to be overcome are getting greater. Therefore, to produce something that is just a little better, requires just a little more skill and time goes on.

Yugoslavian Air Force

The Yugoslavian Ministry of War and Marine has issued proposals for the construction of national aircraft. The Ministry is conducting negotiations for the construction of a new aircraft factory at Zagreb, which is largely to be financed by French capital. A production capacity of 120 planes per year is proposed for this plant.

live observation planes will have two Navy entries. The Merchant's Exchange of 34 Essex Basin, a contest between heavy weight carrying planes, will have two Navy entries as the lone. The following pilots and planes will represent the Navy:

Polymer Race
 Laird S. W. Callahan, U.S.N.—Navy-Wright TX Fighter
 and J. Carl E. Henderson, U.S.N.—Navy-Wright TX Fighter
Box A. J. Williams, U.S.N.—Navy-Curtiss Hoover
Box B. H. J. Brew, U.S.N.—Navy-Curtiss Hoover
Liberty Rubber Race
 2nd Laird S. W. Callahan, U.S.N.—TX plane
 Laird S. W. Callahan, U.S.N.—TX plane
Brooklyn's P. Defender Race
 Laird S. W. Callahan, U.S.N.—TX plane
 1st Laird S. W. Callahan, U.S.N.—TX plane
 2nd Laird S. W. Callahan, U.S.N.—TX plane

Marine Aviators in Virginia Maneuvers

Marine aviators are playing a very important part in the Marine maneuvers now being conducted in Northern Virginia. The pilots and planes are being used in the most important way, and are giving valuable training in the work of cooperating with ground troops in a defensive territory. To quote from a report:

The aviation unit has performed the duties of an observation squadron. Landing fields have been established at each camp site and contact planes have been furnished with the aircraft. The results of the work has been accomplished from the air and photographs of the troops, camp sites and landing fields have been furnished. Much cooperation has been constantly maintained with the ground troops, both before and after the maneuvers. (Continued) All such and cooperation have been given, and the command of the ground and air staff transported as aviation demanded.

The work of the expedition includes New Market, Va., where the battle of New Market of the Civil War will be re-enacted. Instead of the blue and gray, however, the ground armed with moderns, the battle of 1933 will instead with the blue of the last great planes, the aircraft of modern aviation and the airplanes of aerial battles among the French aviation of the twentieth century, Marine.

Planes Work with Submarines

Coastal operations between aircraft and submarines in the West Coast have recently given very satisfactory results at torpedo practice. The planes get the direction and speed of the target ship that the submarine is attacking, and indicate to the submarine. A very considerable improvement in the work of the submarine has resulted. This is a typical example of the work that aviation planes with the cooperation of the surface fleet. Such aviation work, in fact, is an integral part of the fleet. The following, taken from a report from the Commander in Chief of the Battle Fleet on the Pacific, shows the method:

Operations have been conducted involving the use of DHEM spotting planes of Observation Squadron Two in connection with Submarine Division Fourteen. The purpose of these operations is to train in the submarine, to obtain an accurate estimate of the course and speed of target ships in order to aid and expedite the attack.

Navy Pilots Get Pictures of Eclipse

Seven planes from the Annapolis Naval Air Station Battle Fleet showed up in 10,000 ft. at San Diego, Calif., on Sept. 10 and obtained photographs of the total eclipse of the sun on that date. Remarkably quickly another large group of the planes came on the ground from seeing anything of the eclipse, and the watches who moved out with their ground counterparts depend on the Navy for the photographs taken above the clouds.

Lakehurst Has Model Shed and Field

A model shed and landing field has been set up at the Naval Air Station at Lakehurst, N. J., a few feet from the shore of the Navy yard and airport. These models are used in connection with a model ship for the training of personnel in the use and handling of the top sailing. If direct air conditions are essential to the training, the use of proper handling of the model ship under varying conditions.

Where to Fly

ALABAMA	FLY THEM YOURSELF Located by the State. Plans to improve the air line. Ready to fly. Plans to improve. All new planes and motors. All new planes. TACKER AIRCRAFT COMPANY Mobile, Ala. 1000 P. O. Box 1000, Mobile, Ala. 1000
ALABAMA	MID-WEST AIRWAYS CORP. BIRMINGHAM, ALA. One of the five best flying in America. Through flying facilities. Directly across in 1000 ft. Through flying facilities. Directly across in 1000 ft.
ALABAMA	PARTRIDGE, Inc. Aeronautical Instruction Aero. Club of Birmingham 400 S. Adams St. Chicago, Ill.
ALABAMA	One of the largest and best equipped flying fields in the United States. KOKOMO AVIATION CORP. Kokomo, Indiana ALL TYPES OF CREST PLANS
MARYLAND	Large F.M.S. 5 miles S.E. of Baltimore All types of Commercial Airplane, Ships, Hoppers and various other types. AMERICAN AIRCRAFT Co. 1000 P. O. Box 1000, Baltimore, Md.
MASSACHUSETTS	BURNS FLYERS School of Commercial Aviation Land or Water Airfield at Long Lake WINTHROP, MASSACHUSETTS
MINNESOTA	WHITE BEAR LAKE, MINN. The Y. C. Co. is at present with Harold G. Peterson Aircraft Company SCHOOL OF AVIATION
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